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Albanian's Fish Skin, Sustainability and Circular Economy

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ABSTRACT

Leather from fish skins is by no means a new product for Albania. Regularly, this raw material goes unused and is dumped back into the sea, therefore it is wasted. Worldwide with changing consumer tastes, the circular economic practices, and sustainable sourcing, fish skin is a strong candidate to become an industry-shifting material. This is as well the best, most efficient technique to bring sustainability to the leather industry in the country and transform it into a cleaner and more circular sector. The aim of this research is to study the Albanian's fish skin by using traditional tanning techniques to find alternate, sustainable techniques of making leather. The physico-mechanical properties of Albanian fish skins, were determined, where all fish leathers showed adequate physical strength to be used in the manufacture of leather goods such as clothing, footwear, wallets, and many other products.

Keywords: Albanian fish skin, circular economy, leather industry, leather sustainability, alternative leather.

1. INTRODUCTION

The leather and shoe production sector in Albania are an important sector with high potential for the country's economy. The contribution of textile and shoe industry along April 2021 was about 25% of total exports [1].

Leather from fish skin is by no means a new product for Albania. Up to now, the fish skin is a by-product of fish industry, which goes unused and is dumped into the sea, therefore it is wasted. In this way we are losing a valuable raw material and contributing in the contamination of the environment. The utilization of the fish farming wastes and the addition of an economic value has a great importance for the sustainability of the industry [2].

Worldwide with changing consumer tastes, the circular economic practices, and sustainable sourcing, fish skin is a strong candidate to become and industry shifting material. This is as well the best, most efficient technique to bring sustainability to the leather industry in the country and transform it into a cleaner and more circular sector. Due to their biodegradability, durability, firmness and capability of being permeated by air, fish skins can be transformed and processed into leather products instead of throwing a technique [3]. Leather raw material undergo in some processes before it reaches the final material. The tanning process is one of the most important to give leather quality and other special characteristics. Depending in the kind of leather and the quality of tanning, the finished leather is classified and used to produce different products [4].

The importance is to emphasize to apply the bio-tanning material into fish skin to produce fish leather without harm of their physical properties to produce leather with eco-friendly approach [4-6].

The skin can be processed and transformed into quality raw material of unique and peculiar aspect after tanning, due to its resistance and drawing on its surface, mainly skin of fish with scales [7]. Leather made out of this skin was unique from most of the exotic leathers [3]. Fish leather offers to the designer and producers a unique opportunity to work with special leather, creating products owing to their natural surface patterns.

The aim of this study was evaluation of Albanian fish skin for leather industry, processing the fish skin using traditional techniques and the determination of the physico- mechanical properties.

2. EXPERIMENTAL WORK

2.1 Materials and Methods

In this research work was chosen one kind of fish (Codfish). Fish skins were provided from fish farming in south region in Vlora, Albania. There were provided 30 different codfish skin with different dimensions.

The fish skin was preserved by dry salted conservation method. Scales were removed from the body of fish in a careless technique. Then the fish skins are processed by a traditional method turning to crust fish leather, see Figure 1.

Figure 1. Removal of fish scale (descaling)

After these the physical properties were determined in accordance with standard methods. Crust fish leather samples were prepared and conditioned according to standard methods ISO 2418:2017 [8], in standard conditions (temperature 25 °C and humidity 55%). The samples are conditioned for 24 hours.

2.2 Measurement of tensile strength

The tensile strength was measured by using tensile testing apparatus according to standard procedure ISO 3376:2011 [11]. The sample was taken in accordance with ISO 2419:2012 as can be seen in Figure 2 [9].

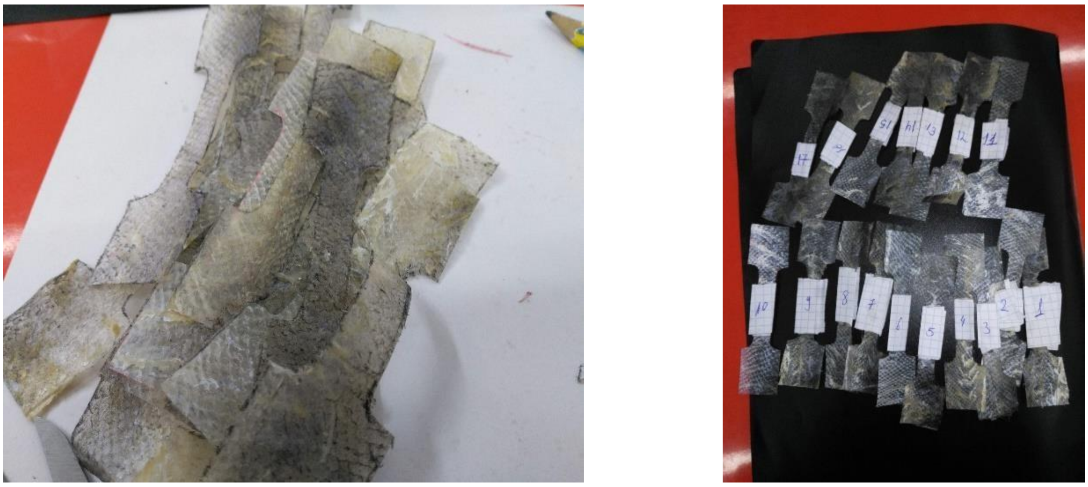

Figure 2. Shape of the fish test pieces for tensile testing

By using Vernier caliper, we have measured the width of each test piece at three positions on the grain and flash side. Then is measured the thickness in three position in accordance with ISO 2589:2016 [10]. After this samples were taken to check the tensile strength. The samples were clamped in the jaws of the tensile apparatus keeping the jaw in a distance of 50 mm apart. The machine is operated until the test piece is broken and the highest force exerted as the breaking force. The tensile strength (*T*n) shall be calculated, in Newtons per square millimeter. Tensile strength, **Tn** (in Newton per square millimeter) is calculated, using equation (1):

$$T_n = \frac{F}{w \cdot t} \tag{1}$$

Where *F* is the highest force recorded in Newton, *w* is the mean width of the test piece in millimeters and *t* is the mean thickness of the test piece in millimeters.

3. RESULTS AND DISCUSSIONS

Physical and mechanical characteristics of fish leather are determined in this study. The measurements of thickness, tensile strength was performed for thirty different fish sample. We have taken into consideration ten of them which not have deviations from standard method, depending this from the technique of processing, the fish age, the percentage of fats, etc. Below are given the electronic results taken from the tensile testing apparatus. Also, there are shown three general graphs of tensile strength and elongation for sample 1, sample 9 and sample 10. Sample 1 is broken near upper jaws, sample 9 is broken near the lower jaws and the last one is broken in the middle of the sample.

Table 1 until 3 and the Figures 3 until 4 are showing the measurement results for tensile strength and elongation of the fish for respectively sample 1, 9 and 10.

Table 1. Present the results of measurements performed according to ISO 6943:2003, sample 1

Name: Codfish Leather (Sample 1), R	Temperature: 23 °C	Humidity: 50 %
Tensile 41.00 N N	Force at Length N	Max. Force 41.00
Elongation 9.82 %	Elongate Length 4.91 mm	Time 0003.01 s

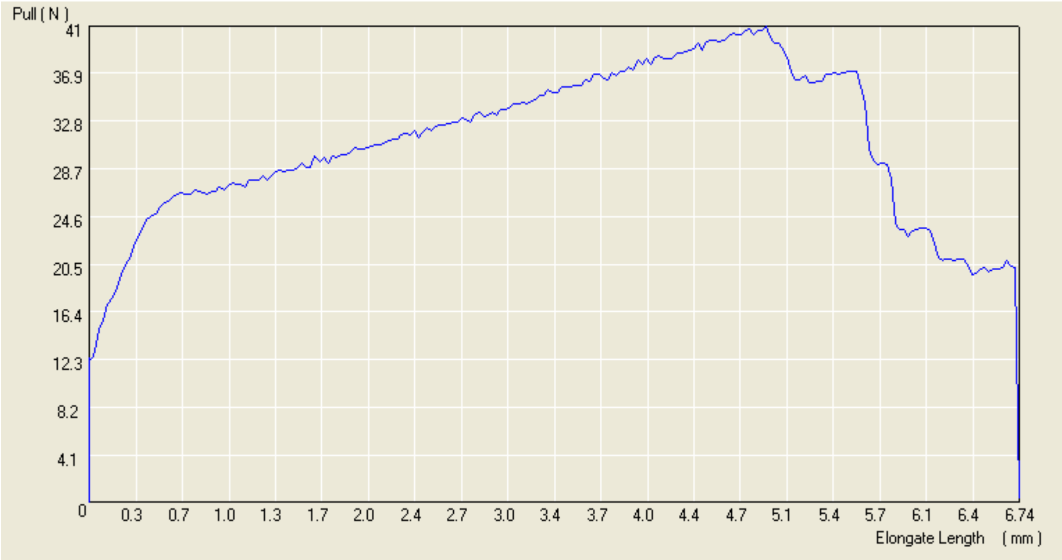

Figure 3. Graph of tensile strength and elongation for fish sample 1

Table 2. Present the results of measurements performed according to ISO 6943:2003, sample 9.

Name: Codfish Leather (Sample 9), R	Temperature: 23 °C	Humidity: 50 %
Tensile 71.97 N 71.97 N	Force at Length N	Max. Force 41.00
Elongation 18.84 %	Elongate Length 9.42 mm	Time 0005.92 s

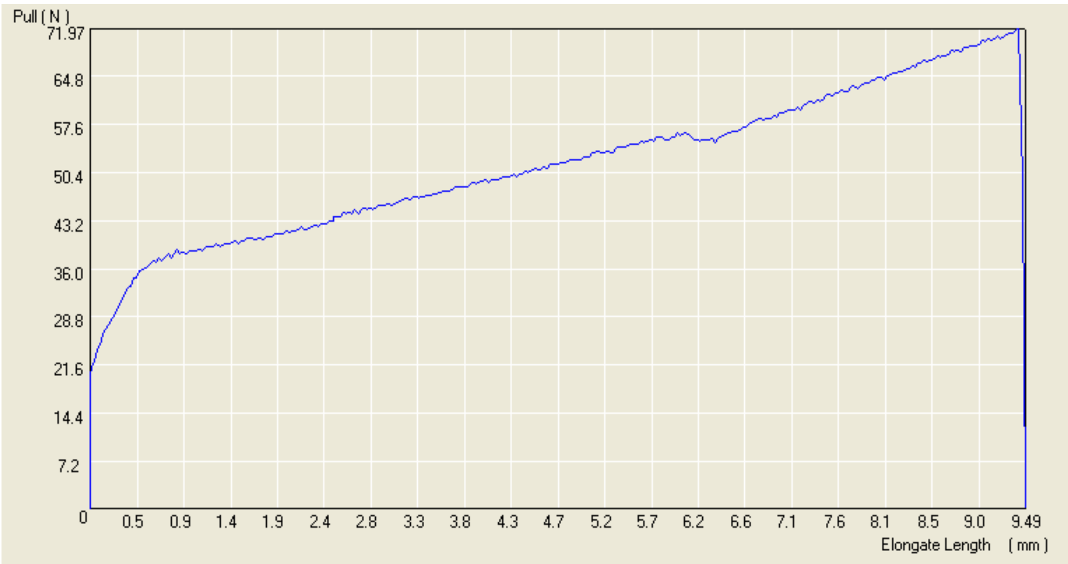

Figure 4. Graph of tensile strength and elongation for fish sample 9

Table 3. Present the results of measurements performed according to ISO 6943:2003, sample 10.

Name: Codfish Leather (Sample 10), R	Temperature: 23 ℃	Humidity: 50 %
Tensile 71.97 N 71.97 N	Force at Length N	Max. Force 41.00
Elongation 24.16 %	Elongate Length 12.08 mm	Time 0007.49 s

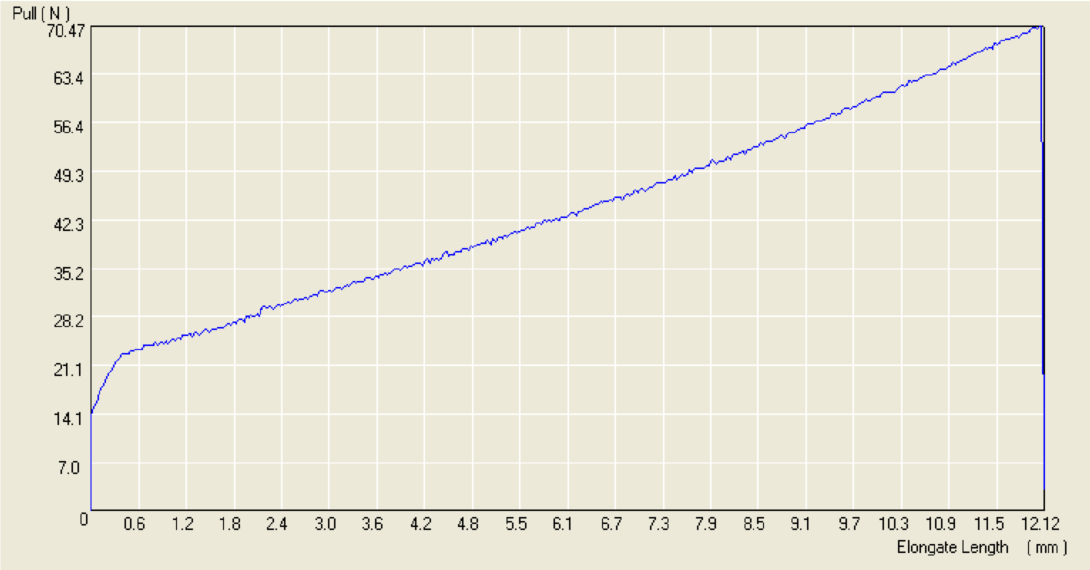

Figure 5. Graph of tensile strength and elongation for fish sample 10

In the Table 4 are shown the mean values of thickness (mm) and force (N) for ten fish leather samples.

Table 4. Mean value of thickness and force (N) for 10 samples in parallel directions.

Fish Samples	**Thickness (mm)**	**Fmes (N)**
Sample 1	0.174	41.00
Sample 2	0.213	62.83
Sample 3	0.185	59.70
Sample 4	0.208	60.45
Sample 5	0.282	70.35
Sample 6	0.222	47.00
Sample 7	0.346	70.00
Sample 8	0.239	88.00
Sample 9	0.307	72.00
Sample 10	0.245	70.47

Furthermore, Table 5 depict the mean values of tensile strength.

Table 5. Mean value of Tensile strength (N/mm^2) for 10 samples.

Fish Samples	Tn (N/mm^2)
Sample 1	23.56
Sample 2	29.49
Sample 3	32.27
Sample 4	29.06
Sample 5	24.94
Sample 6	21.17
Sample 7	20.23
Sample 8	36.82
Sample 9	23.45
Sample 10	28.76

From the graphs of the Figures 3 until 5 and based on the results of tensile strength (Table 5) we can conclude that the fish leather samples mentioned in the study have high values of resistance, which prove that they are processed properly. The high or low tensile strength is influenced by several factors including the type of tanner, the tanning process, the tanning time, the species and the age of the animal [12-14].

Tensile strength of leather is an important indicator of quality of leather. Moreover the value of elongation shows that the tested leather can be used for garments or other leather products, because leather with high elongation value quickly became deformed so may use lose usability while leathers with low elongation values tear very easily [15-17].

4. CONCLUSIONS

The Albanian fish leather studied in the present paper showed high tensile strength, which demonstrate that the samples are processed properly using traditional techniques of tanning. The tensile strength results confirm for a good fish leather quality. Fish leather offers the designer and producer wide possibilities to create valuable and unique products. Furthermore, we can assume that the fish skin taken from farm fishing should be an important value in our country's economy.

The future research work will be focused on evaluation of chemical and other physico-mechanical characteristics of Albanian fish leather. There will be tested other kind of fish that could be found in Albanian coast. We will try to raise awareness the farm-fishing and the leather producer for the importance of this asset in the economy

CONFLICT OF INTERESTS

The authors would like to confirm that there is no conflict of interests associated with this publication and there is no financial fund for this work that can affect the research outcomes

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